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WILLING-TO-CERTIFY SOURCES OF SUPPLY OF COMMODITIES COVERED BY COMMERCIAL STANDARDS

Willing-to-certify sources of supply are lists prepared by the Bureau, of manufacturers who have expressed their desire to supply materials on contracts based on certain selected standards and specifications, and the willingness of these manufacturers to certify to the purchaser, upon request when contracts are placed, that the material thus supplied is guaranteed to comply with the requirements and tests of the standards and specifications.

These lists are intended to facilitate the use of nationally recognized standards by minimizing the disadvantages due to the inability of small-quantity purchasers to determine whether or not delivered commodities conform to the requirements of the standards.

It is to be definitely understood that certificates are to be issued by the manufacturers to the purchasers and not to the Bureau, which assumes no responsibility of any kind in the transaction.

Letter Circular LC277a which has just been revised, consists of lists of willing-to-certify sources of supply of a wide variety of commodities covered by Commercial Standards. Approximately 1,750 manufacturers have indicated their desire to be listed among the above willing-to-certify sources of supply.

The letter circular is available for distribution to all interested agencies and individuals upon request to the Division of Codes and Specifications, National Bureau of Standards, Washington, D. C.

Information concerning the application of the certification plan or any other phase of the work on standardization, including the labeling plan, may be obtained from the above source.

REPORT OF TWENTY-SEVENTH NATIONAL CONFERENCE ON WEIGHTS AND MEASURES

Miscellaneous Publication M159, which has just been released, is a report of the Twenty-seventh National Conference on Weights and Measures. (See Technical News Bulletin 243; July

[1] Published with approval of the Director of the Budget.

1937.) The report contains addresses by the Secretary of Commerce and the president of the conference; papers and discussions on court decisions involving Chicago weighmaster ordinance, consumer interest in weights and measures supervision, proposed Federal weights and measures legislation, standardization of packages of canned foods, results of vehicle-scale tests made by the Bureau, fundamentals of scale design, licensing of scale repairmen, weights and measures salesmanship, activities of National Scale Men's Association, use of vehicle scales in highway planning survey, liquid measures of nonstandard sizes; and reports on specifications and tolerances for scales, weights, vehicle tanks, and liquid-measuring devices.

Copies are obtainable from the Superintendent of Documents, Government Printing Office, at 15 cents each.

ARCHITECTURAL ACOUSTICS

The fundamental principles governing the construction of an acoustically successful auditorium are no longer new, but are frequently ignored. In Circular C418, Architectural Acoustics, which replaces the Bureau's Circular C396, the usual defects of auditoriums are discussed and some suggestions are made as to how these defects can be corrected. The principles of planning an auditorium are set forth and an example is worked out showing their practical application to the designing of a new auditorium or to the curative treatment of one that has proved unsatisfactory.

The problem of noise quieting is also considered and a method of computing the noise reduction due to an acoustic treatment is given.

Copies of this publication are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each.

SOUNDNESS TEST FOR LIME

A test for "pitting and popping" of limes used in the finishing coat of plaster was devised by D. L. Bishop and published in Rock Products, July 18, 1931. This test consists of steaming specimens in an autoclave for 2 hours. The specimens of the finishing coat are prepared by mixing 2 volumes of lime putty with 1 volume of unretarded calcined gypsum (which shall pass Federal Specification SS–G–901) and sufficient water to form a paste, and then spreading a layer, $\frac{1}{16}$ to $\frac{1}{8}$ in. thick on a 4- by 4-in. glass plate. The specimens are then set aside for 2 hours to allow the gypsum to set, after which the specimens are placed on a rock in an autoclave and steamed for 2 hours at a pressure of 120 lb./in.^{2} Unsoundness as applied to finishing limes is evidenced by the development of crater-like holes known as "pits" or "pops." It is essential, in conducting the test, that prior to steaming, the specimens be so stored as to prevent evaporation of the water, because otherwise a disintegration or cracking of the specimens may occur, which bears no relation to the development of unsoundness on the wall. The soundness of the calcined gypsum used in this test should be assured by testing with a lime putty that has been previously steamed in the autoclave for 2 hours at 120-lb. pressure.

This test, essentially that described in Tentative Methods of Physical Test for Limestone, Quicklime, and Hydrated Lime (American Society for Testing Materials Designation: C 110–34T), is particularly advantageous as a plant control method because (if a soaking period is dispensed with) the test can be completed in about 3 hours. The test is also more reliable than the longer one given in the standard specification.

Very good correlation was originally obtained between the autoclave test and the actual development of pits and pops, but because of the continued interest in the method, more panels have been prepared to check further the reliability of the method. Nineteen panels have been prepared and are now about 1 year old. Of these limes, 11 of them tested unsound and have developed unsoundness (pitting) in the panels, upon aging in the laboratory. Two of the limes that tested unsound have not yet developed unsoundness. Five limes tested sound and have remained sound. One lime tested sound, but has developed unsoundness. The status of all the panels previously reported in Rock Products, July 18, 1931, has remained the same with the exception of one panel (No. 22) which, although testing sound, has developed one pop (over an area of $1\frac{1}{4}$ ft^2). Out of the total of 52 panels tested, 34 limes have tested unsound and developed unsoundness in the panels. Twelve have tested sound and have remained sound in the walls. Three limes have tested unsound and have remained sound, whereas three also tested sound but have developed unsoundness in the walls.

It should not be construed that the limes on the market will test unsound in the same proportion as they have in the limes here reported.

THE PERMANENCE OF PLASTICS

The use of superlatives in describing new products which present unusual advantages for many applications is natural on the part of laboratories which have devoted months of enthusiastic efforts to their development. However, the plastics industry is graduating from the period in which such terms as "unbreakable," "permanent," "corrosionproof," "lightfast," and similar vague adjectives are sufficiently descriptive of the properties of the materials which have been synthesized. The designer, engineer, and ultimate consumer want definite facts about behavior of plastics in actual service.

The effects of composition and molding conditions on the durability of plastic products are discussed in a paper by Gordon M. Kline, presented as part of a symposium on plastics before the American Society for Testing Materials, at Rochester, N. Y., on March 9, 1938. A review of methods which have been used to measure the resistance of plastics to light, heat, water, and chemicals shows that, at present, actual exposure tests are more reliable than accelerated aging in evaluating the effect of ultraviolet light on plastics.

The tendency of plastics to flow at elevated temperatures under load serves as a basis of classification systems adopted in England and Germany. These methods are compared with those in use in this country for the determination of distortion under heat. Not much is known about the effect of continuous operation at elevated temperatures on other properties, such as appearance, strength, dimensional stability, and composition. Absorption of water by plastics, when exposed to damp air or when immersed, is undesirable because of its adverse effect upon electrical properties and dimensional stability. Standard methods of measuring absorption are, therefore, important.

In the establishment of test methods for plastics, the determination of their resistance to chemical reagents is generally treated as a special case. It would be advantageous, however, to have recognized compounds and concentrations for use in these tests and a uniform procedure to follow, so that data obtained on the chemical resistance of new plastics would be comparable with those in the literature for other plastics.

Definite conditions of temperature and relative humidity for testing plastics should be decided upon, as this would make the correlation of test data for strength, hardness, thermal and electrical properties more reliable and would simplify the setting up of laboratory-testing facilities. Test methods adopted in other countries should be carefully studied so as to prevent needless confusion in reporting on the properties of plastics.

PHOTOELASTIC DETERMINATION OF STRESSES AROUND A CIRCULAR INCLUSION IN RUBBER

The problem of the stress distribution around a rigid inclusion in a body under tension is of considerable interest in a number of fields, and yet there has been comparatively little work done on it. In the case of rubber the problem of the rigid inclusion is particularly important, not only for inclusions of appreciable size, but also with respect to microscopic and submicroscopic filler particles. For the experimental solution of such stress problems the extremely useful method of photoelastic analysis has recently come into prominence. The necessary data are obtained by observing in polarized light the patterns observed when a transparent model is stressed. Extensive use of the method has been made with models constructed of glass, Celluloid, Bakelite, and other materials, especially the organic plastics.

Since a previous investigation (Thibodeau and McPherson, J. Research NBS 13, 887 (1934) RP751) has indicated that some rubber compounds fulfill many of the requirements for a desirable model material, a rectangular rubber model loaded in simple tension at two opposite edges has been used in a study of the stresses around a rigid circular inclusion with cemented boundary. A paper (RP1083) by Wilfred E. Thibodeau and Lawrence A. Wood, in the Journal of Research for March presents the results of this study, and, after discussing the fundamental principles, gives a detailed outline and illustration of the exact experimental procedure used for the solution of problems by this method.

The lines of stress, originally introduced merely as aids to the mathematical treatment of the theory of elasticity, are in this case actually traced out from observations of the interaction of polarized light with the stressed medium. By the application of graphical methods, the final results of the stress distribution are obtained from the data with a minimum of advanced mathematics. The method is useful when applied to problems in which there is

doubt of the validity of the assumptions involved in a theoretical treatment, or problems in which the mathematical difficulty of theoretical treatment is excessive. The method can be applied to a material like rubber where stress and strain are not proportional, and even to a plastic material as well as to an elastic material.

In the present work the maximum stresses near the boundary of the disk are found to be about 50 percent greater than the average applied stress. The experimental results are compared with those given by a theoretical treatment of this problem, and quite satisfactory agreement is obtained.

AN INSTRUMENT FOR ESTIMATING TAUTNESS OF DOPED FABRICS ON AIRCRAFT

The linear deflections of doped fabrics under load serve as criteria for comparing the tautness of panels. The usual type of tautness meter employs weights for loading and can, therefore, be used only on approximately horizontal surfaces. This prevents its application for estimating the tautness of many wing and fuselage sections on the airplane itself or during their storage in vertical positions. In the course of experimental work at the Bureau, in cooperation with the Bureau of Aeronautics, U. S. Navy Department, on the doping qualities of cellulose plastics, Gordon M. Kline and Herbert F. Schiefer have developed a spring-loaded instrument to measure the relative tautness of doped fabrics in both horizontal and vertical positions.

The instrument consists essentially of two dial gages, with spindles connected to each other and to a helical spring so that one gage measures the movement of a spherically shaped foot and the other registers the load applied by the foot to the specimen. These gages and the spring-loading device are attached to an aluminum beam, which has a three-point support for resting on the framework of a panel or on any two adjacent ribs of a wing. Graduations on the beam indicate the width of the span so that the instrument may be centered quickly and conveniently.

The practicability of the instrument for estimating tautness was demonstrated by tests made on the doped fabrics of airplanes. The average deflections of the fabrics under 1-lb load (measured between 3-oz and 19-oz loads) varied from 0.052 to 0.124 in. The fabrics which gave deflections of more than 0.124 in. under the conditions of the test were judged by a number of men familiar with aircraft maintenance to be in poor condition. The actual deflection of the fabric under the 1-lb load is considered to be a more reliable criterion of the tautness than a deflection constant calculated on the assumption of a linear relation between deflection and spacing. However, areas with maximum rib spacing and span should be selected for test, and the shorter dimension between supports should be recorded.

RADIO METEOROGRAPHY AND INVESTIGATION OF UPPER-AIR PHENOMENA

A paper (RP1082) by Harry Diamond, W. S. Hinman, Jr., and F. W. Dunmore, which will be published in the Journal of Research for March, describes one of the new radio methods for studying the earth's upper atmosphere by means of miniature transmitting and measuring equipment carried aloft on small unmanned balloons. The original object of this research was the development of the radiometeorograph system for the U. S. Navy Department described in Technical News Bulletin 250 (February 1938). Recent service tests by the Navy Department show that the radio meteorograph can satisfactorily replace airplanes in gathering weather information.

The new method and instruments have also been found applicable in studying other important upper-air phenomena. One is the measurement of the height and vertical thickness of existing cloud strata; another, the measurement of ultraviolet solar intensities in the stratosphere. (Technical News Bulletin 250, February 1938.) Examples of other phenomena which may be measured are the electrical properties of the air (such as conductivity and voltage gradient), cosmic-ray intensities, and upper-air wind velocities.

The miniature radio transmitter employs an ultra-high-frequency oscillator operating on 50 to 200 megacycles per second, and modulated with a varying audio modulating frequency of from 20 to 200 cycles per second. The frequency of the modulating oscillator is controlled by special resistors; these may be varied mechanically by instruments responding to the phenomena being measured, or they may be special devices, the electrical resistances of which vary inherently in accordance with the phenomena. The modulation

frequency is thus a measure of the property of the atmosphere being studied. Several phenomena may be measured successively, the corresponding resistors which vary in accordance with these phenomena being switched to control the audio modulation by means of a novel device.

This switching device, briefly referred to in the preceding number of this Bulletin, utilizes the decrease in atmospheric pressure as the balloon rises for moving a small switch-arm over a set of electrical contacts separated by insulating strips. The contacts are so spaced that for a decrease in atmospheric pressure equivalent to a few hundred feet rise of the balloon the arm will move from one contact to the next. The arm reaching selected contacts causes the radio transmitter to send down signals having predetermined audio notes which identify these contacts. The device thus permits the successive measurement of a number of upper-air phenomena in any desired sequence, and in addition serves as an accurate measure of the barometric pressure (and hence of altitude).

To secure the values of the upper-air properties as the balloon soars upward, it is not necessary to have an operator at the ground station busily measuring the audio pitch of the signals received from the balloon transmitter, nor even to listen to them. Automatic receiving and recording equipment are employed to plot these data graphically on a chart which moves under a pen controlled by the received signals. The pen sets itself according to the pitch of the audio note being received. The final record gives a complete picture of the variation of the upper-air phenomena being measured, as a function of height above the earth's surface.

The radio-meteorograph instrument is housed in a balsa-wood box 6 by 6 by 4½ in., which weighs less than 2 lbs. A small parachute is provided between the 5-ft balloon and the equipment, which carries the equipment to earth (without danger of injury to life or property) when the balloon reaches its ceiling height (12 to 15 miles high) and bursts. A special arrangement permits the release of the parachute and return of the equipment from any desired altitude.

Besides the miniature radio transmitter and power supply, the radio meteorograph contains the pressure-switching unit, a special electrolytic thermometer, and a hair hygrometer. These last two instruments were described in the preceding number of this Bulletin. The pressure-switching unit places the temperature resistor in the circuit whenever the switch-arm is on an insulating strip, and the humidity resistor in circuit when the arm is on an electrical contact. Hence, the modulating frequency changes from a value corresponding to the temperature to one corresponding to the relative humidity and vice versa at definite increments in the altitude of the balloon. The ground station recorder plots a record of these modulating frequencies so that the air pressure, temperature, and relative humidity are readily determined.

In the measurement of cloud heights and thickness, a photoelectric cell is employed which varies its electrical resistance approximately inversely as the amount of light falling on its window. This resistor controls the value of the audio modulating frequency of the balloon transmitter. When clouds are present, the amount of sunlight penetrating through the clouds is reduced. Hence, when the balloon is below the clouds, the photocell resistance will be high and the audio note measured by the recorder quite low. As the balloon penetrates into the cloud, the photocell is exposed to more and more light and the audio frequency gives a measure of this variation. Finally, upon emerging from the top of the cloud, the photocell is exposed to full sunlight and the audio note measured by the recorder becomes quite high and constant. Measurement of the barometric pressure shows at what altitudes the balloon penetrated into and emerged from the cloud.

TRANSFORMER METHOD FOR MEASURING HIGH ALTERNATING VOLTAGES

An interesting instance of the pendulum-like swings so often noted in human affairs is found in RP1079 by Francis B. Silsbee and Francis M. Defandorf, which will appear in the March number of the Journal of Research. In the days of Benjamin Franklin, almost the only known manifestations of electrical forces were those associated with the storage, statically, of a very tiny quantity of electricity at a rather high voltage. For the most precise quantitative measurement of such voltages, Sir William Snow Harris devised, 100 years ago, an electrometer in which the attraction between two oppositely charged metal

disks was weighed by a chemist's balance. (See following item.) The researches of Sir William's contemporary, Faraday, on the manifestations of electricity, when circulated in much larger quantity at very much lower voltage by dynamos, swung the trend of thought in a new direction and led to the development of the present electric power industry.

Successive improvements in technique, and the constant economic pressure for transmitting larger amounts of power over greater distances at higher efficiency, have led year by year to a steady increase in the voltages used. The precise measurement of these high potentials in terms of the small unit, the volt, agreed upon internationally many years ago, has become increasingly difficult as the quantity to be measured has become tens and finally hundreds of thousands of times larger than the international standard. As a result, the pendulum has now swung back, and the Bureau has recently put into commission for such measurements an attracted disk electrometer based upon the identical principles of the ancient instrument, but so refined as to be 100 times more accurate and to measure voltages 10 times as great. Careful comparison between the new instrument and the entirely independent method hitherto used for stepping up from the known voltage of a standard cell has shown an agreement to within 0.02 percent, thus adding greatly to our confidence in the accuracy of high-voltage measurement by either method.

AN IMPROVED ABSOLUTE ELECTROMETER

A thorough study has recently been completed by Herbert B. Brooks, Francis M. Defandorf, and Francis B. Silsbee, of the performance of the Bureau's absolute electrometer, mentioned in the preceding item. The electrometer is a highly specialized instrument for measuring with extreme accuracy high alternating voltages such as are now widely used for the transmission of electric energy. In it the electric attraction exerted on a light aluminum disk, about 6 in. in diameter, by a larger fixed disk, placed below and parallel to the first and oppositely charged, is weighed by a chemist's balance. The total electrical force is only 2 g, but the balance is so sensitive that the observer by watching, on a scale 6.5 ft. away, a spot of light reflected from a mirror on the balance beam can detect a change in this force of 0.0001 part.

An air current such as that rising from a warm radiator with a speed of only 2 ft./min. is sufficient to cause an error of appreciable magnitude. To minimize such disturbances the laboratory is kept at a uniform temperature day and night, and observations are preferably made only during those few hours of each day when the temperatures indoors and outdoors are the same, in which case there are no drafts of air along the walls.

Auxiliary microscopes are used to measure the position of the suspended disk relative to the guard plate in which it hangs with an accuracy of 0.00003 in. A set of guard hoops surrounding the instrument serves to protect the disk from electrical attractions from surrounding objects.

The results obtained with this electrometer indicate that the instrument is accurate to a few hundredths of one percent.

The complete report of these experiments will be published in the Journal of Research for March as RP1078.

REFERENCE TABLES FOR THERMOCOUPLES

A large and constantly increasing proportion of the temperature measurements required in industrial processes is made by means of thermocouples, and of these, the greater proportion consists of iron and constantan wires. Constantan is an alloy of about 55 parts of copper with 45 parts of nickel. In order to use a thermocouple it is necessary to have an indicating or recording instrument, which is usually graduated to indicate temperatures in degrees Fahrenheit. The indicating instrument is relatively expensive and lasts for many years, while the thermocouple wires are comparatively cheap but have to be renewed frequently. The user of thermocouples must, therefore, be able to obtain new thermocouple wires which have the same properties as the original ones, so that temperatures will be indicated correctly when the new couple is connected to the old instrument.

A manufacturer of indicating or recording instruments may make them to suit the characteristics of a stock of iron and constantan wire which he may have selected. When the original stock is exhausted, it may be difficult to obtain a new stock having the desired characteristics, which are simply those of the original stock. Each pyrometer user has, therefore, faced the problem

of finding a source of supply which could furnish the kind of material he had started with. As methods of wire manufacture have gradually developed it has become more difficult to obtain the kinds of wire made many years ago.

After making measurements on a large number of representative samples of iron, constantan, and copper obtained from sources which (experience indicates) will in the future probably continue to produce materials having the same properties, William F. Roeser and Andrew I. Dahl have prepared new standard tables showing these properties. Thermocouples to match these new tables can, therefore, be obtained by combining materials readily available from a number of sources.

The table for copper-constantan is the same as one of those now in use, but none of the existing tables for iron-constantan could be matched accurately by readily available materials. The new table for iron-constantan is near the average of previous tables, and is not greatly different from the one table most widely used. Actually, most of the couples sold to match this old table really match the new table better than the original one.

If the new tables are accepted generally by users and manufacturers of thermocouples, the problem of replacing thermocouples will be greatly simplified. The Journal of Research for March will publish these tables as part of RP1080.

MEASURING THE THICKNESS OF NONMAGNETIC COATINGS ON IRON AND STEEL

Many organizations have adopted specifications for the thickness of plating. The methods now used for testing the thickness of plating for acceptance and for plant control result in the destruction of the coating and sometimes of the article. Nondestructive methods of testing are desirable because they permit the testing of a larger number of samples without increased expense. A paper by Abner Brenner, which will be published as RP1081 in the Journal of Research for March, describes a rapid, nondestructive method for measuring the thickness of nonmagnetic coatings, such as zinc, copper, tin, paint, or enamel, on steel. The method depends on the decrease in the attraction of a permanent magnet for iron when the two are separated by a nonmagnetic coating. The measuring instrument consists of a simple spring balance with a freely suspended magnet, which is calibrated with coatings of known thickness. It can be used to measure coatings up to 0.015 in. in thickness.

Magnetic measurements of the thickness of commercial samples of plating, as compared with measurements of thickness by standard methods, gave an average error of ±10 percent for most coatings. The results for hot-dipped tin coatings, which are usually only 0.0001 in. thick, are about 25 percent low (probably because of alloying), unless the instrument is calibrated against similar tin coatings.

Because nickel is less magnetic than steel, nickel coatings on steel may be measured by this method, using a suitable calibration curve.

FIRE-CLAY LADLE SLEEVES

Bottom-pouring ladles are equipped with stopper rods to control the flow of steel during casting. These metal stopper rods are pivoted at the top of the ladle and pass vertically through the molten metal to the nozzle at the bottom. To prevent stopper rods from being attacked by the molten metal they are incased in sleeves made from fire clay. The number of sleeves required on a rod varies according to the size of the ladle. The sleeves are joined by fire-clay cement and any space surrounding the rod may or may not be filled with sand, ground firebrick or similar material.

The practice followed by a foundry cooperating with the Bureau in a study of fire-clay sleeves is as follows: The iron rod, stopper, and sleeves are dried at a low temperature after assembling. The interior of the ladles in which they are used is preheated to approximately 700° C (1,292° F) just preceding their filling with the molten metal. The assembled rod at room temperature is placed in position immediately after the preheating of the ladle is completed. The ladle is then moved to the furnace and filled with the molten metal. The fire-clay sleeves are subjected, therefore, to two thermal shocks during this procedure.

The study, which was conducted by Raymond A. Heindl and George J. Cooke, embraced eight brands of sleeves and represented the product of practically all manufacturers in the United States except those on the Pacific coast. Certain properties of these sleeves were determined in the laboratory and records were obtained of their behavior in steel-foundry service.

The results obtained were coordinated and the following conclusions ap-

pear justified on the basis of those results:

1. The temperature of softening of the sleeves in all but two cases was below the temperature of the molten steel which surrounded them. In the extreme case the metal was hotter by approximately 115° C (207° F).

2. Excessive cutting and pitting during the casting of heats (average time 18 min., maximum about 30 min.) was noted in many sleeves of low refractoriness.

3. The porosity of all brands of sleeves ranged from 11.4 to 21.8 percent; one brand showed a range from 9.0 to 20.6 percent for different sleeves. Those of lowest porosity in this brand gave serious trouble as a result of spalling and cracking.

4. The range in Young's modulus was from 1,842,000 to 4,964,000 lb/in^2. The modulus of rupture ranged from 1,020 to 2,300 lb/in^2. The highest value for Young's modulus accompanied by the lowest value for extensibility was found in the brand of sleeves causing much trouble in foundry service.

5. The silica content ranged from 55.42 to 65.99 percent. Service results of sleeves in contact with acid open-hearth slags were satisfactory in all of the limited number of heats observed.

6. The brand of sleeves which gave the most satisfactory results in service was very refractory, had fairly high porosity, a fairly uniform and not too high thermal expansivity, and a moderately high extensibility.

7. Considerable variation in the properties and service results was noted in different sleeves of some of the brands, indicating lack of uniformity of the product.

The complete report of this work will be published as RP1084 in the Journal of Research for March.

NEW AND REVISED PUBLICATIONS ISSUED DURING FEBRUARY 1938

Journal of Research[2]

Journal of Research of the National Bureau of Standards, volume 20, number 2, February 1938 (RP1069 to RP1077, inclusive). Price 25 cents. Annual subscription 12 issues, $2.50.

Research Papers[2]

[Reprints from December 1937 issue of Journal of Research]

RP1050. Method and apparatus for the rapid conversion of deuterium oxide into deuterium. John W. Knowlton and Frederick D. Rossini. Price 5 cents.

RP1051. Dimensional changes in aerial photographic films and papers. Raymond Davis and Emory J. Stovall, Jr. Price 10 cents.

RP1052. Guloheptonic acids and *a-d-a* guloheptose. Horace S. Isbell. Price 5 cents.

RP1053. Arc and spark spectra of ytterbium. William F. Meggers and Bourdon F. Scribner. Price 5 cents.

RP1054. New test for dimensional changes in offset papers. Charles G. Weber and Martin N. V. Geib. Price 5 cents.

RP1055. An improved apparatus for measuring the thermal transmission of textiles. Richard S. Cleveland. Price 5 cents.

RP1056. Effect of yaw on vane anemometers. Roy H. Heald and Paul S. Ballif. Price 10 cents.

RP1057. Use of arsenious oxide in the standardization of solutions of potassium permanganate. Harry A. Bright. Price 5 cents.

RP1058. Soil-corrosion studies, 1934. Bituminous coatings for underground service. Kirk H. Logan. Price 10 cents.

Circulars[2]

C418. Architectural acoustics. Paul R. Heyl and V. L. Chrisler. (Supersedes C396.) Price 5 cents.

Simplified Practice Recommendations[2]

R19–37. Asbestos paper and asbestos millboard. (Supersedes R19–28.) Price 5 cents.

R85–37. Adhesive plaster. (Supersedes R85–28.) Price 5 cents.

Miscellaneous Publications[2]

M159. Report of the Twenty-seventh National Conference on Weights and Measures attended by representatives from various States, held at the National Bureau of Standards, Washington, D. C., June 1, 2, 3, and 4, 1937. Price 15 cents.

Technical News Bulletin[2]

Technical News Bulletin 250, February 1938. Price 5 cents. Annual subscription, 50 cents.

MIMEOGRAPHED MATERIAL

Letter Circulars

Letter circulars are prepared to answer specific inquiries addressed to the

[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $2.50 per year (United States and its possessions, and Canada, Cuba, Mexico, Newfoundland, and the Republic of Panama); other countries 70 cents and $3.25, respectively.

National Bureau of Standards and are sent only on request to persons having definite need for the information. The Bureau cannot undertake to supply lists or complete sets of letter circulars or to send copies automatically as issued.

LC512. Automobile costs. (An outline of factors entering into problem of estimating cost of operation of a car.)

LC513. Sources of radio information. (Supersedes LC474.)

Technical Information on Building Materials

The supply of these notes, each of which consists of three or four pages, giving the important facts on some one aspect of the properties or use of building materials, is necessarily limited. Their distribution will be confined to Government officials concerned with building projects and to architects, engineers, and home builders. Requests should make clear the actual need for the information at the time of writing. Letters should be addressed to the Division of Codes and Specifications, National Bureau of Standards, Washington, D. C. The following note was issued since the February 1938 number of the Technical News Bulletin was printed:

TIBM–61. Study of underground corrosion of nonbituminous metal coverings.

Report of the National Hydraulic Laboratory

Copies are sent only in answer to specific requests addressed to the National Bureau of Standards.

Current hydraulic laboratory research in the United States, Bulletin VI, Series A (January 1, 1938).

RECENT BUREAU ARTICLES APPEARING IN OUTSIDE PUBLICATIONS[3]

Averages of critical frequencies and virtual heights of the ionosphere, observed by the National Bureau of Standards, Washington, D. C., September and October 1937. Terrestrial Magnetism and Atmospheric Electricity (Johns Hopkins Press, Baltimore, Md.) **42,** No. 4, 408 (December 1937).

Remarks on S. Chapman's note on radio fade-out and the associated magnetic disturbance. S. S. Kirby. Terrestrial Magnestism and Atmospheric Electricity **42,** No. 4, 420 (December 1937).

Optical specification of light-scattering materials. Deane B. Judd. Paper Trade J. (10 East Thirty-ninth St., New York, N. Y.) **106,** 39 (January 6, 1938).

Cosmic-ray observations in the stratosphere. L. F. Curtiss, A. V. Astin, L. L. Stockmann, B. W. Brown, and S. A. Korff. Physical Review (11 East Thirty-eighth St., New York, N. Y.) **53,** 23 (January 1, 1938).

Permeability of organic polysulphide resins to hydrogen. T. P. Sager. (Reprinted from J. Research NBS.) India Rubber J. (3738 Shoe Lane, London, E. C. 4, England) **94,** 512 (October 30, 1937); India Rubber World (420 Lexington Ave., New York, N. Y.) **97,** 41 (December 1, 1937); Rubber Chemistry and Technology (Rubber Division, Am. Chem. Soc., Mills Bldg., Washington, D. C.) **11,** 163 (January 1938).

A decade of research on the chemical constitution of petroleum. F. D. Rossini. Proc. Am. Petroleum Inst. (50 West 50th St., New York, N. Y.) **18,** 111 (1937); Oil and Gas J. (Tulsa, Okla.) **36,** No. 26, 193 (November 12, 1937); Refiner and Natural Gasoline Manufacturer (Gulf Publishing Co., 3301 Buffalo Drive, Houston, Tex.) **16,** 545 (November 1937).

Micrographs of high purity iron carbon alloys. H. K. Herschman. Metal Progress (7016 Euclid Ave., Cleveland, Ohio) **32,** 781 (December 1937).

Square soldier wire for small jobs. C. E. Waters. The Modelmaker (7611 West State St., Wauwatosa, Wis.) **15,** 46 (December–January 1938).

An improved method for preparing cast iron transverse test bars. A. I. Krynitsky and C. M. Saeger. Trans. Am. Foundrymen's Assn. (222 West Adams St., Chicago, Ill.) **45,** 753 (1937).

Optical glass at the National Bureau of Standards. A. N. Finn. J. Optical Soc. Am. (Cornell University, Ithaca, N. Y.) **28,** 13 (January 1938).

Optical specification of vitreous enamels. D. B. Judd, W. N. Harrison, and B. J. Sweo. J. Am. Ceramic Soc. (2525 North High St., Columbus, Ohio) **21,** 16 (January 1938).

[3] These publications are not obtainable from the Government. Requests should be sent direct to the publishers.

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